

## **RADIATION ENVIRONMENT INSIDE SPACECRAFT**

Dr. Patrick O'Neill, NASA Johnson Space Center, will present a detailed description of the radiation environment inside spacecraft. The free space (outside) solar and galactic cosmic ray and trapped Van Allen belt proton spectra are significantly modified as these ions propagate through various thicknesses of spacecraft structure and shielding material. In addition to energy loss, secondary ions are created as the ions interact with the structure materials. Nuclear interaction codes (FLUKA, GEANT4, HZTRAN, MCNPX, CEM03, and PHITS) transport free space spectra through different thicknesses of various materials. These "inside" energy spectra are then converted to Linear Energy Transfer (LET) spectra and dose rate – that's what's needed by electronics systems designers. Model predictions are compared to radiation measurements made by instruments such as the Intra-Vehicular Charged Particle Directional Spectrometer (IV-CPDS) used inside the Space Station, Orion, and Space Shuttle.